12. West Kitsap Conservation Unit

12.1. Introduction

The West Kitsap Conservation Unit includes Big Beef Creek, Big Anderson Creek, and the Dewatto River watersheds, their estuaries and associated marine nearshore areas. Historically, summer chum salmon were present in Big Beef Creek, Big Anderson Creek and the Dewatto River. Sporadic sightings of summer chum salmon have been noted in Stavis Creek. Seabeck Creek appears to have habitat conducive to summer chum suggesting that they may have been present historically. Currently, all summer chum in the West Kitsap conservation unit are considered extinct. A reintroduction program using Quilcene stock was initiated in Big Beef Creek in the mid-1990s (see SRP section 5 for a summary of this supplementation program). Salmon conservation and recovery in the West Kitsap conservation unit is a matter of addressing both the habitat needs of summer chum salmon and restoring the processes and habitat that sustain all species of salmon in the watershed and, particularly, in the adjacent marine nearshore areas of Hood Canal.

Current habitat conditions and situations were assessed using a variety of sources. Several sources were used to assess the summer chum salmon stocks in the Eastern Strait of Juan de Fuca conservation unit. This Salmon Recovery Plan (SRP) will not repeat the details of these assessments, but instead refers the reader to the cited documents. All material and documents referenced in this SRP should be considered part of, and integral to, the recovery of summer chum salmon. These sources provided the primary reference and knowledge base for development of these aspects of the SRP. Details of the EDT assessments for the Eastern Strait of Juan de Fuca stocks, including a summary of the baseline performance measures, and a summary of strategic priorities, are provided in Lestelle et al, (2005a) (see Appendix A). The EDT Method is a widely used tool to help prioritize habitat restoration and protection measures for salmon populations. It provides a systematic way of diagnosing habitat conditions that have contributed to the current state of populations, and it enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits to salmon populations of actions that might be taken to address habitat related issues impeding recovery. Other detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Kuttel (2003), and May and Peterson (2003).

May and Peterson (2003) in their report “Landscape Assessment and Conservation Prioritization of Freshwater and Nearshore Salmonid Habitat in Kitsap County” categorized various areas within the West Kitsap conservation unit as refugia. Refugia can be defined as “habitats or environmental factors that provide spatial and temporal resistance and/or resilience to aquatic communities impacted by natural and anthropogenic disturbances” (May and Peterson 2003).

Refugia areas are important for maintaining populations of salmon. Refugia act to "re-seed" nearby areas after natural or man-made disturbances.

The Stavis Creek and Dewatto River watersheds were given the highest rating of "priority refugia with natural ecological integrity." The nearshore areas along the West Kitsap conservation unit were also classified by May and Peterson (2003). The area stretching from Rendsland Creek north to Big Anderson Creek and the area near the enclave of Holly was rated as "secondary refugia with altered ecological integrity" or areas that are generally in a fair condition and able to provide some habitat for summer chum salmon. The nearshore area from Big Anderson Creek into Stavis Bay was rated as category 'A' refugia, "priority refugia with natural ecological integrity" and generally exhibits properly functioning conditions. Stavis Bay itself is considered in good condition, "primary refugia with altered ecological integrity." Seabeck area was rated as fair and the remainder of the nearshore heading north from Big Beef Creek to Foulweather bluff is considered to be in a "good" condition (May and Peterson 2003). The main conservation function and recovery action focus for the West Kitsap conservation unit will be the protection and restoration of the marine nearshore areas.

12.2. Geographic Description and Human Population Distribution

The West Kitsap Conservation Unit includes Big Beef Creek, Big Anderson Creek, and the Dewatto River watersheds. Also included within this unit are the marine nearshore waters starting at Rendsland Creek in Mason County, and traveling the east shoreline north to the mouth of Hood Canal, and the northern boundary of Kitsap County. Included along this nearshore north of Big Beef Creek is the Bangor Submarine Base. This conservation unit lies mostly within Kitsap County with a southern portion in Mason County. Figure 12.1 provides a map of the West Kitsap Conservation Unit.

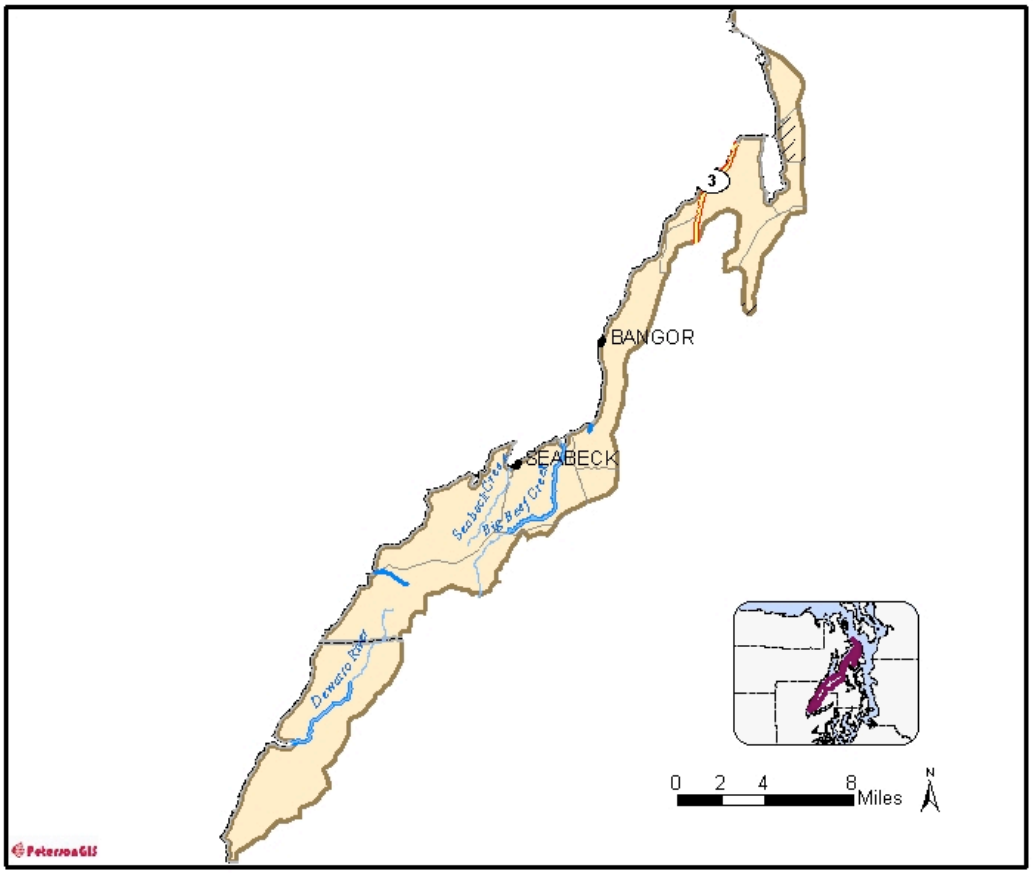

Figure 12.1. West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

The Big Beef Creek watershed covers an area of almost 14 square miles with 11 miles of mainstem stream length (WDFW and PNPTT 2000). Big Anderson Creek is located in southwestern Kitsap County. The stream enters Hood Canal approximately one-half mile north of the small community of Holly (WDFW and PNPTT 2000). The Dewatto River is located in the southwestern portion of Kitsap Peninsula, approximately 5.5 miles north of the Great Bend of Hood Canal, west of the Tahuya River, and south of Stavis and Big Beef creeks

(WDFW and PNPTT 2000). Originating on the plateau of the Kitsap peninsula, the Dewatto follows a glacial outwash channel as it flows southwesterly and parallel to Hood Canal for approximately 8 miles to saltwater. The headwaters originate in till and outwash sands and gravels. The narrowest portion of the valley is near the river mouth. The watershed area is approximately 23 square miles and there are approximately 30 miles of tributary streams. The Big Anderson Creek watershed is approximately 5 square miles in area, with 4 miles of mainstem and 13 miles of tributaries (WDFW and PNPTT 2000). Similar to other streams in the West Kitsap conservation unit, Big Anderson Creek originates in headwater wetlands and flows through a confined ravine before opening into a broad floodplain in the lower one-half mile. The small estuary includes a large intertidal delta.

The community of Seabeck, located just south of Big Beef Creek, is the area of the most significant human development. The Big Beef Creek watershed has a significant population density. Another area of high density human population is the town of Port Gamble at north end of the west side of Port Gamble Bay. Figure 12.2 shows population density within the West Kitsap conservation unit.

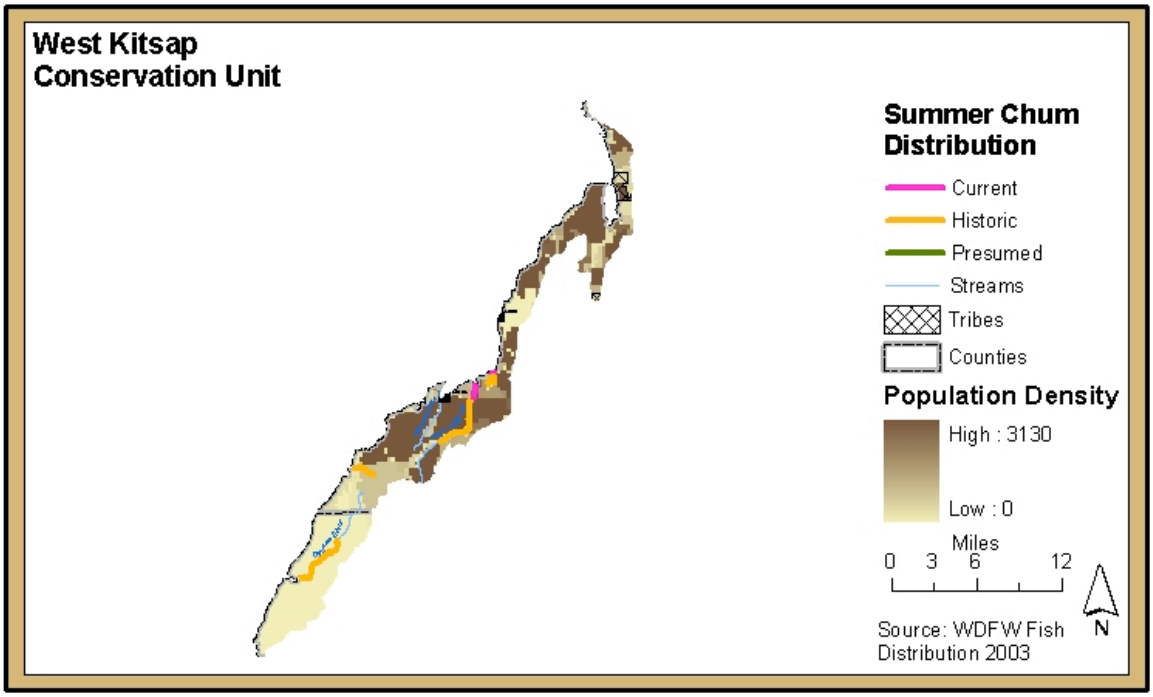

Figure 12.2. Human population density (people per square mile) for the West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

12.3. Summer Chum Salmon Stocks' Description & Distribution

Several sources were used to assess the summer chum salmon stocks in the West Kitsap conservation unit. This SRP refers the reader to the cited documents in this section. All material and documents referenced in this SRP should be considered part of and integral to the recovery of summer chum salmon. The reader is urged to review the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000) and subsequent supplemental reports. Summer chum salmon in Hood Canal and the Eastern Strait of Juan de Fuca were also assessed based on application of the Ecosystem Diagnostic and Treatment (EDT) Method. The EDT Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle, et. al. 2005a). The complete detailed EDT for summer chum salmon can be found at http://www.wa.gov/hccc/ and click on the Salmon Recovery Planning Activities link. On that page can be found links to various documents and the EDT web site for summer chum salmon. The web address for the EDT site: www.mobrand.com/edt/sponsors/show_sponsor.jsp?sponsor_id=11

Naturally produced summer chum salmon originating from the West Kitsap Conservation Unit are considered extinct (WDFW and PNPTT 2000). Summer chum from the Big Quilcene River stock have been reintroduced into Big Beef Creek. Spawning in the mainstem of Big Beef Creek is assumed to have occurred primarily in the lower reaches up to river mile (RM) 2.0. Historical distribution in Big Beef Creek is assumed to be as far as RM 6.0. The potential for historic summer chum salmon production is assumed for Stavis Creek, Seabeck Creek, Big Anderson Creek, and the Dewatto River.

Current, historic and presumed summer chum salmon distribution in the West Kitsap Conservation Unit is shown in Figure 12.3.

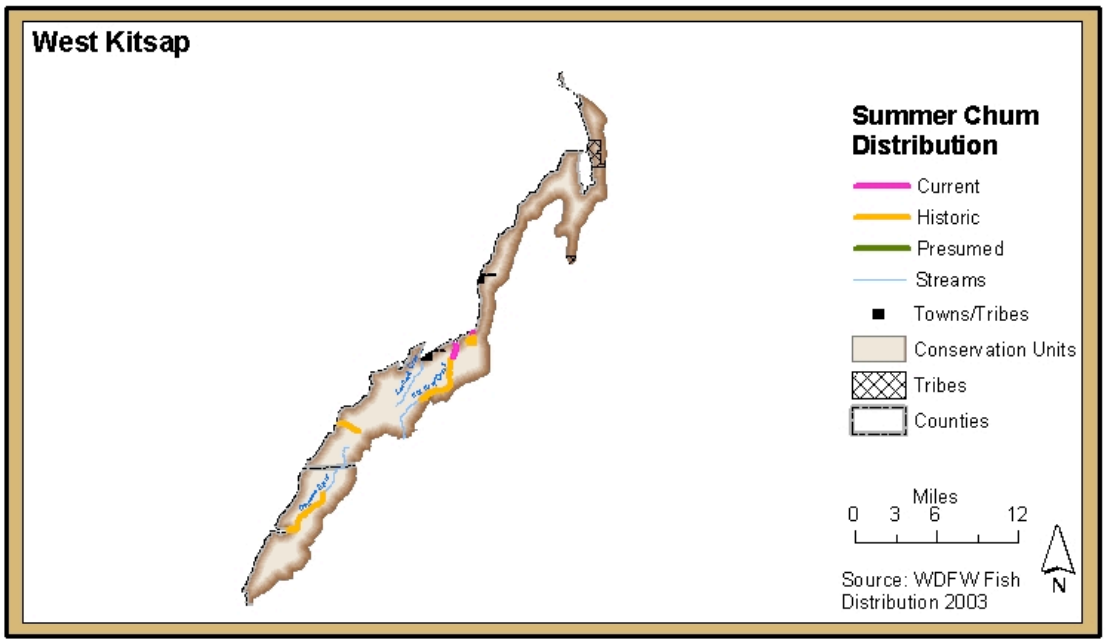

Figure 12.3. Map of the West Kitsap Conservation Unit showing current, historic and presumed summer chum salmon distribution (map produced by Gretchen Peterson, Peterson GIS).

Summer chum salmon escapement (number of adults returning to spawn) for Big Beef from the years 1974-2003 is presented in Figure 12.4.

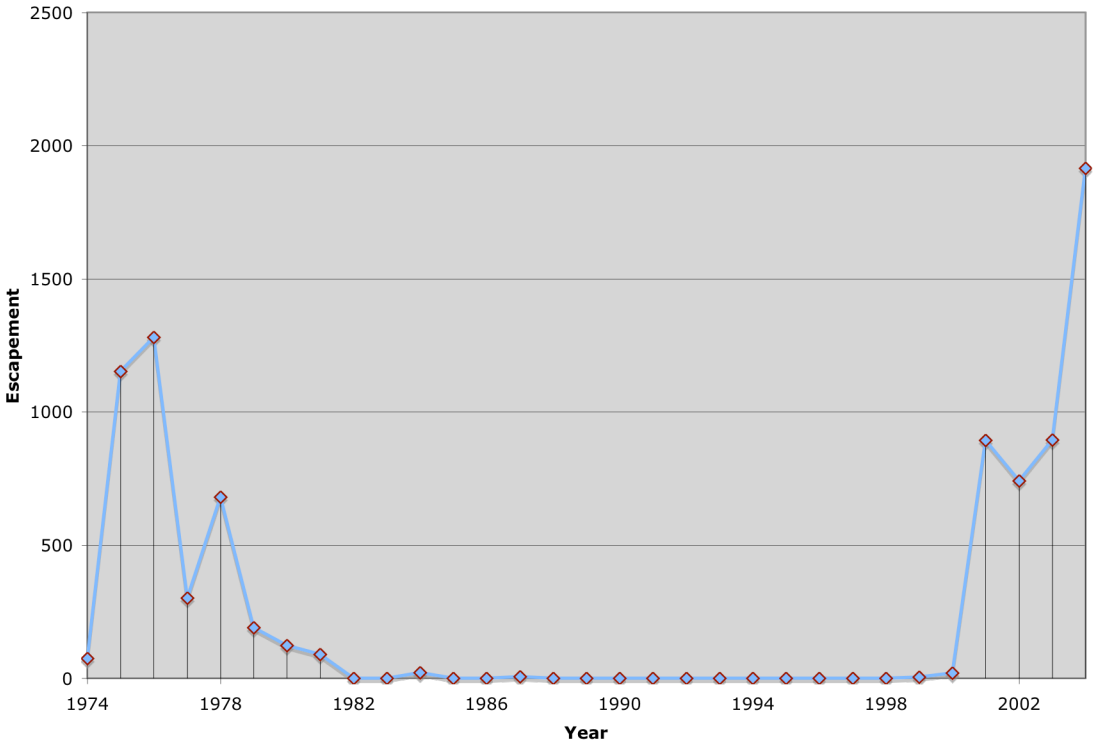

Figure 12.4. 1974-2003 summer chum salmon escapement for Big Beef Creek (data source: WDFW and PNPTT 2003, 2004, and 2005).

Escapement estimates exceed 1,000 fish in the years 1975 and 1976, although in the surrounding years (before and after) the escapement numbers were in the hundreds. With the exception of 22 in 1984, no summer chum has returned to Big Beef Creek (prior to the supplementation program) since 1982. Returns from the supplementation program began to show significant numbers beginning in 2001.

PNPTT and WDFW (2003) have not identified the stocks in the West Kitsap Conservation Unit to target for recovery. Big Beef Creek, by virtue of the current supplementation program (using Quilcene stock), is considered by the SRP as a stock to consider for restoration and protection. At this time it is not clear how the PSTRT or NMFS will view a supplemented stock, such as Big Beef Creek, relative to recovery. Since the stock is genetically similar to Quilcene, should Big Beef be included in the accounting as Quilcene or separately as Big Beef Creek? Should Big Beef Creek summer chum salmon be considered as part of the larger Hood Canal population? Do supplemented stocks contribute to and account for recovery? At what point in the supplementation program do supplemented stocks become considered as naturally produced (should they be determined successful)? These questions should be addressed in a viability analysis by the

PSTRT. Until that is completed, the SRP will assume that recovery of the ESU will need to consider abundant and well dispersed stocks throughout the ESU, including West Kitsap.

Other streams in the West Kitsap conservation unit have shown sporadic observations of summer chum adults. Most notably, fish have been observed in Big Anderson Creek and the Dewatto River (both of which had summer chum historically). Estimated escapements for Big Anderson Creek show a small population of just over 200 spawners occurring in the 1970s. That population does not appear to have been stable, with estimates of 0 and 16 adult spawners during 1974 and 1978 respectively. Estimated escapement drops to zero in the early 1980s (WDFW and PNPTT 2000). Estimated escapements for the Dewatto River show a gradual reduction of adult spawners over time, from escapements of more than a thousand in the early 1970s, to hundreds in the later 1970s, to less than 100 in the 1980s, and finally, to zero or near zero in the 1990s (WDFW and PNPTT 2000). Ten summer chum salmon were observed in the Dewatto River in 2002 (contributing to a 54 fish total from 1999-2002), suggesting that natural re-colonization is occurring (WDFW and PNPTT 2003).

12.4. Habitat overview & environmental conditions

12.4.1. Factors contributing to the decline of summer chum salmon

Detailed assessments of habitat and environmental conditions are provided in the SCSCI (WDFW and PNPTT 2000), Kuttel (2002), and May and Peterson (2003). May and Peterson (2003) summarized several common problems or factors that are likely contributing to the decline of salmonid in the West Kitsap conservation unit:

- Natural stream ecological processes have been significantly altered due to the cumulative effects of watershed land-use practices and human encroachment into the stream-riparian ecosystem.
- There has been a significant shift in the natural hydrologic regime of many watersheds, especially those undergoing urbanization. This is characterized by increases in peak flow frequency, duration, and magnitude due to increased stormwater runoff from lands that have been converted from native forest and wetlands to developed landscapes dominated by impervious surfaces.
- Streambed stability and spawning gravel quality have been degraded by high stormflow scour and fine sediment deposition. Major fine sediment sources include logging roads, construction sites, and agricultural fields.
- Stream channel morphological changes have resulted from direct alterations such as agricultural channelization or floodplain diking. In addition, streambank erosion has increased in frequency and extent due to higher stormflows, loss of natural vegetation cover, and subsequent streambank armoring.

- There is a general lack of adequate large woody debris (LWD) in streams, particularly large, stable coniferous “key” pieces that are critical to forming pools, providing cover for juvenile fish, retaining organic matter, and maintaining instream habitat complexity. In addition, there is a general lack of adequate, high quality rearing habitat (pools) for juvenile salmonids and the lack of deep “holding” pools for adult salmon migration.
- There has been a significant degradation and loss of natural floodplain processes in our rivers and larger stream systems, including the loss of functional off-channel wetland habitat. This is mainly due to dredging, bank armoring, and stream channelization. Past and current agricultural land-use has had a significant impact on floodplain and riparian processes in a number of lowland watersheds. In addition, development has also continued this process of stream channel manipulation.
- Almost all local streams have experienced a loss of natural riparian function due to removal or alteration of natural riparian forest vegetation. This degrades water quality, increases streambank erosion, reduces shade needed for water temperature regulation, and impacts instream habitat conditions through the decline in LWD recruitment.
- Stream-riparian corridor fragmentation is a major problem in many watersheds. This fragmentation has impacted the structure and function of our stream-riparian ecosystems. In addition, there are a significant number of culverts, diversion dams, and other fish passage barriers throughout these same watersheds.
- Estuarine and nearshore processes have been significantly impacted by physical alteration of nearshore ecological structure and function. These impacts include extensive shoreline bulkhead construction, loss of shoreline forest and large woody debris recruitment, loss of shoreline riparian cover and shade, and degraded water quality. In addition, natural sediment transport and beach nourishment processes have been disrupted as nearshore drift-cells have been altered by shoreline armoring, dock construction, and other human activities. All of these modifications have impacted salmonid habitat in the nearshore environment to some extent.

The majority of baseflow in Big Beef Creek is provided through hydrologic continuity with a shallow perched aquifer with indirect hydrologic continuity from a deeper aquifer known as the Seabeck Aquifer. The Seabeck Aquifer contributes baseflow predominantly at the mouth of Big Beef Creek. Minimum streamflow averages 3.1 CFS and maximum flows average around 200 CFS, with a maximum discharge of 1,500 CFS recorded in 1967 (WDFW and PNPTT 2000).

The SCSCI (WDFW and PNPTT 2000), the “Limiting Factors Report for WRIA North 14 and West 15” prepared by the Washington Conservation Commission (Kuttel 2003), and May and Peterson (2003) provide details of the various habitat factors and environmental conditions affecting summer chum salmon in this

conservation unit. The factors and conditions are summarized for Big Beef Creek in table 12.1.

Table 12.1. Big Beef Creek

Factors for decline	Life stage most affected	Remarks
Sediment aggradation, fines	Spawning, incubation, juvenile migration	The lower river channel, where historically most of the summer chum production occurred, has been impacted by upstream land use practices, with concurrent reductions in survival in all life history stages. Past logging and road building on steep unstable slopes in the lower Big Beef watershed have caused mass wasting, channel widening and bank instability, causing a 800% increase in sediment bedload over natural, undisturbed conditions. The majority of this coarse sediment has been deposited within the lower stream reaches, reducing available pool habitat and causing the channel to widen and become shallower. Channelization, along with the construction of the WDFW fish weir, has also increased aggradation by constricting the channel and forcing the bedload to be deposited upstream from the weir. The bridge causeway on the Seabeck Road has also restricted the freshwater-saltwater interface and reduced the potential flushing action of sediment associated with tidal action. During summer low flow periods, the aggraded and widened channel has been reported to impede upstream passage and reduce spawning success for adult summer chum due to increased predation associated with loss of stream cover. In 1969 and 1971, the entire summer chum run was moved into the UW Research Station spawning channel because of unstable conditions in the main channel and in anticipation of channelization activities. % loss of summer chum redds due to scour, fill, and channel displacement, with an average survival to emergence rate of 9.4%. In the same study, he noted 16.3% fine sediment (less than 0.8 mm in diameter) in spawning gravel, a rate at which permeability and intergravel survival would be substantially diminished.

Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability)	Spawning and incubation	Channel alterations, in combination with sediment aggradation described above, have reduced complexity in lower Big Beef Creek, affecting all major life history stages. Monitoring data collected in 1993 and 1994 indicated 0.17 pieces of LWD per meter, rated as a high impact (Appendix Report 3.8). Pool habitat is rated as moderate impact (46% percent pools, pool spacing of 2.4) with the majority of pools being formed by the roots of standing trees or old growth stumps, and log jams anchored by remnant old growth LWD. In a recent field review of Big Beef Creek, Cederholm noted the loss of stable, deep pools present in the 1960s associated with the loss of LWD and sediment deposition in the lower river. Reduced LWD levels have been attributed to illegal cedar salvage, stream cleanout of log jams, channelization activities. At least three separate incidents of channel dredging, dike construction, wood removal, and channel relocation by private landowners have been documented in the lower river from the 1950s. In response to extreme channel aggradation and braiding in the lower river, and concerns for stranding and reduced survival of summer chum, the University of Washington channelized 1,968 feet of the lower river in 1969. At the same time, the U.W. constructed dikes consisting of excavated gravel on the southwest side of the river, further constricting the floodplain and creating a new sediment source for downstream areas. Channelization attempts were largely unsuccessful in dealing with sediment aggradation and channel instability in lower Big Beef Creek. Routine spot dredging upstream of the weir has occurred since the 1970s, with deposition of dredge spoils along the bridge causeway and a floodplain service road. Diking, construction of a road within the floodplain to service an artesian well for the Big Beef rearing facility operated by NMFS, and filling and alteration of side channel habitat associated with the construction and operation of the Big Beef Research Station, have also contributed to

		reduced channel complexity in the lower 2 miles of the river.
Riparian degradation	Spawning and incubation	Riparian zones which were historically a mixed forest of old growth cedar with limited areas of deciduous species associated with disturbance regimes (primarily windthrow and channel migration) are now predominantly composed of mixed conifer and deciduous (47%), deciduous species (48%) and 36% less than 12 inches in diameter. In comparison to adjoining watersheds, the riparian forest of lower Big Beef Creek is relatively intact (76% of the total riparian length having a buffer greater than 132 feet, low impact rating), with only minor areas of narrow riparian zone related to logging and limited residential developments (at RM 3.5 and below Lake Symington). Other land use impacts to the buffer include roads, dikes, and the UW Research facility in the lower river.
Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)	Juvenile rearing and migration	The research facility, road, bridge construction and sediment aggradation near the mouth of the stream have decreased the quality and amount of the subestuarine habitat that is most immediately available to emigrating summer chum fry. Three areas, totaling 0.64 ac or 1.4% of historic delta area have been filled; this filling, as with evacuation of one pond covering <0.72 acres or 1.5% of the historic delta area, is associated with the fish research and culture facilities of the Big Beef Research Station. A fish counting weir operated by WDFW, tends to act as a channel constriction and sediment trap, affecting upstream channel conditions and sediment transport processes into the estuary. Historically, timber from logging operations in the area was dumped from trucks into Big Beef Harbor upstream from the sandspit at the harbor's mouth where they were rafted to adjacent mills). The Seabeck Road bridge and its associated causeway crosses 0.03 mile of the middle reach of the delta, essentially narrowing the opening previously associated with a sandspit originating on the east side of the estuary. Aerial photographs from 1947, 1961, and 1997 show that extension and reinforcement

		of the bridge causeway has significantly constrained tidal interaction with the estuary, causing the estuary to infill with sediment, and reducing channel complexity. This observation is reinforced by historic accounts that at one time, small boats were able to navigate into the estuary and lower channel (S. Neuhaueser, personal communication). Adult intertidal spawning may also have also been impacted by these changes.
Flow (summer low and peak flows)	Spawning, incubation, juvenile migration	Summer low flows that occur during late August through the end of September, especially during natural drought cycles, have impacted adult migration and spawning success. Reports of adult stranding were recorded in the late 1960s and 1970s, mostly as a result of channel aggradation. Future withdrawals of water for domestic water supply, both from the shallow perched and deeper aquifer, have the potential to further compound the problem. The contribution from the Seabeck Aquifer to baseflows at the mouth of Big Beef Creek, is considered important, since the zone of influence overlap almost perfectly with the area of summer chum distribution. Winter flood flows have increased as a result of upstream urbanization effects, logging, road building and manipulation of flows at Lake Symington. As of 1993, 3.1% of the watershed was covered by impervious surfaces, approaching a rate at which changes to habitat quality are first noted. Changes in the duration and magnitude of peak flows with relatively minor precipitation have been observed since the late 1980s. This causes channel instability, including greater scouring and filling of sediments in the channel. Several incidences of scour in excess of 22 cm, the typical depth for egg deposition.

12.4.2. Human development and land use

Population density in the West Kitsap Conservation Unit is significant in select areas of the Big Beef Creek watershed and adjacent lands. Figure 12.5 Presents human population density for the Big Beef Creek watershed.

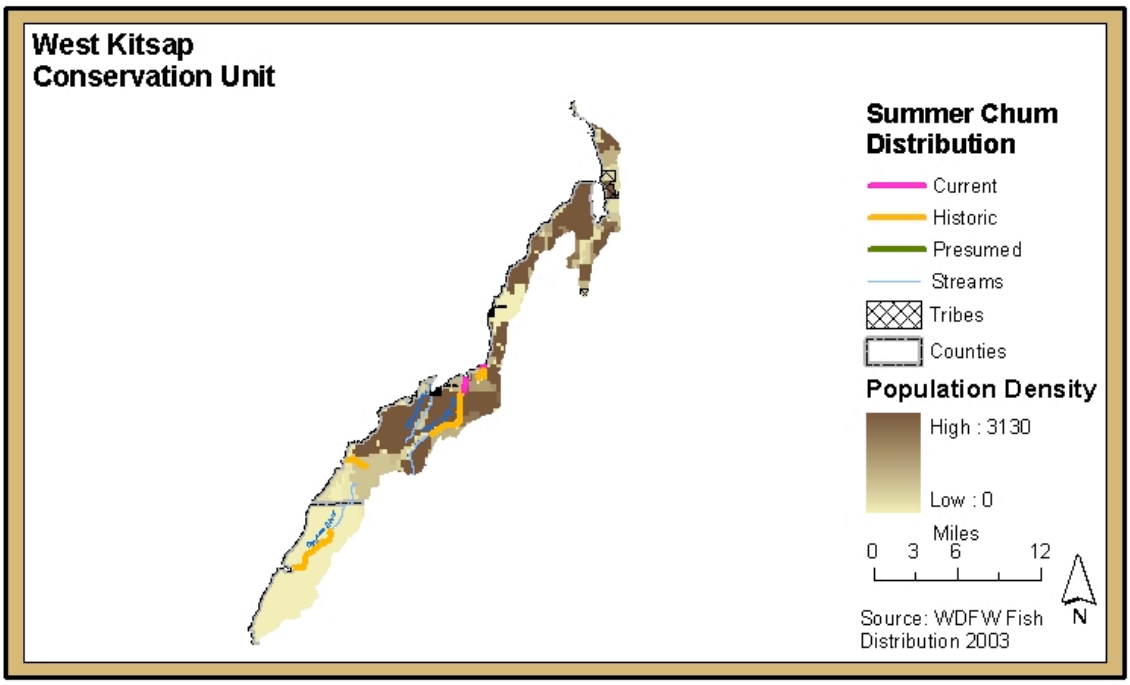

Figure 12.5. Human population density (people per square mile) for the West Kitsap Conservation Unit (map produced by Gretchen Peterson, Peterson GIS).

In the past, the prevailing land use in the upper watershed has been timber harvest; some lands are still managed for harvest of timber resources including several large blocks of land managed by the Department of Natural Resources. Historic logging activities began in earnest with the establishment of Camp Union in 1920, with the entire watershed above river mile (RM) 5.0 to the headwaters, logged by 1950. Agricultural developments exist at several locations along the upper stream reaches. Since 1970, residential development has proliferated, especially concentrated around and just downstream of Lake Symington. Lake Symington has had a primary impact on the lower system; lake levels and downstream flows were managed, for many years, to meet the needs of the lakeshore residents, with little regard for effects on downstream flows. WDFW has recently incorporated provisions in the lake's rules of operation to protect downstream flow requirements for fisheries resources. Below Lake Symington, there is limited residential development along the stream, with the majority occurring on the flat till plain above the river. The University of Washington's 320-acre fisheries research facility is located between RM 0.0 to 0.8. WDFW operates a weir at RM 0.1 to count upstream and downstream coho salmon migrants. The Hood Canal Salmon Sanctuary program has actively been

purchasing key riparian habitat upstream of the U.W. research facility (WDFW and PNPTT 2000).

Land-use in the Big Anderson Creek watershed is primarily industrial forestry operations conducted by several large landowners and the Department of Natural Resources. Logging in the Big Anderson most likely began in 1920s, with the establishment of the Camp Union logging camp. Between the 1920s and 1944, the headwaters were entirely denuded, with erosion observed in steep tributaries. At that time, most of the remaining basin was logged. As the habitat recovered in the following decades, logging was again observed in 1984 aerial photos and continues to the present. Three private residences and a small farm are located along the lower mile of the stream. A road bisects the floodplain near the mouth, and another road is adjacent to the river, and within the 100-year floodplain, from RM 0.5 to the mouth. Forty-five percent of the riparian zone is occupied by roads (36%) and agriculture (9%) (WDFW and PNPTT 2000).

Historically, the prevailing land use in the sparsely developed Dewatto River watershed has been timber harvest, with a large portion of the watershed still managed for timber. Several Christmas tree farms are the only agricultural developments. Rural residences are scattered throughout the drainage. The riparian zone is 87% forested, the highest percentage of all 20 watersheds. Rural homes account for 4% and agriculture 2% of riparian land uses (WDFW and PNPTT 2000). Figure 12.6 shows the current land use designations for the Kitsap County portion of the West Kitsap conservation unit.

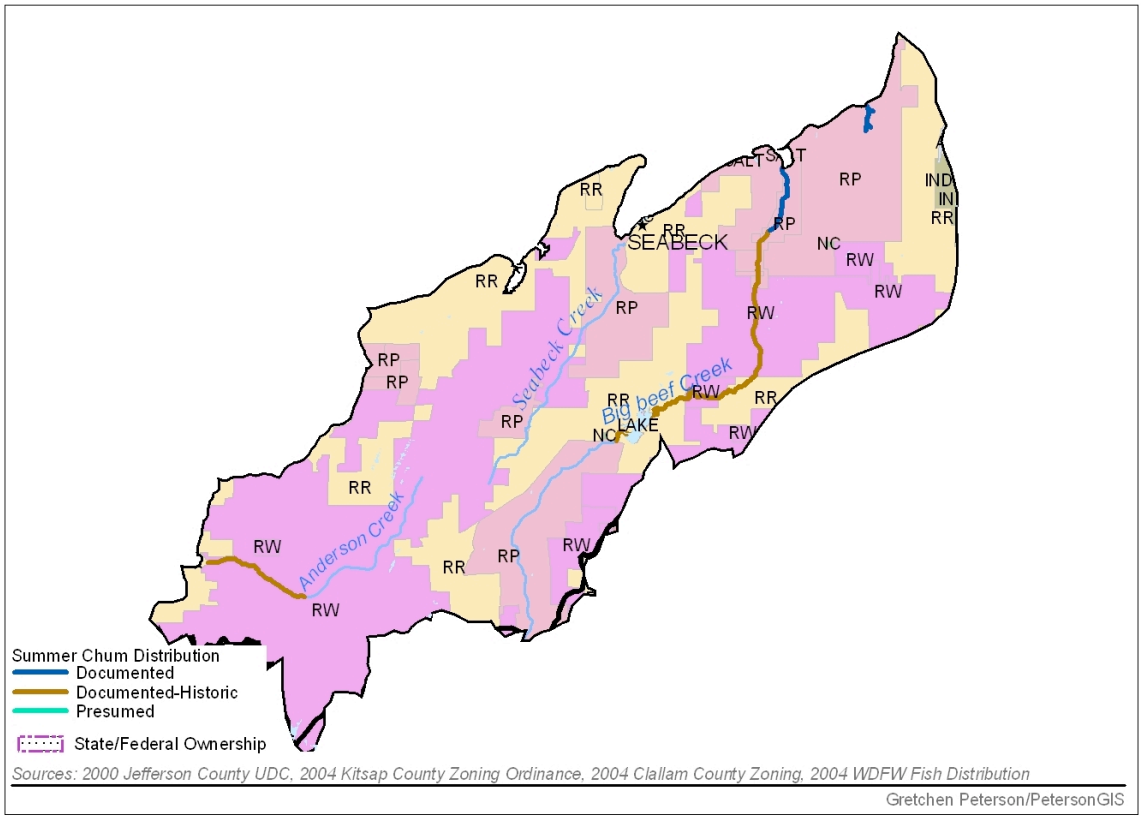

Figure 12.6. Zoning for the Kitsap County portion Big Anderson Creek, Seabeck Creek and Big Beef Creek watersheds) of the West Kitsap conservation unit.

Kitsap County (Kitsap County Code Title 17 Zoning) has designated the lower Big Beef Creek watershed as mostly Rural Protection (RP) zone. This zone is intended to protect and maintain the rural residential character and environment of Kitsap County and to provide for home sites with acreage. This zone is applied to areas without many public services at housing densities consistent with the physical characteristics of the area included in this zone. Big Anderson Creek watershed is zoned as Rural Wooded (RW) with a density of one dwelling unit per 20 acres. The RW zone is designated to encourage the preservation of forest uses, retain an area's rural character, and conserve the natural resources while providing for some rural residential use. The mouth of Dewatto River is designated by Mason County, Resource Ordinance 77-93, adopted January 2005 (Mason County Code 17.01), as Rural Residential, RR5, (1 dwelling unit per 5 acres). The remainder of the lower Dewatto River watershed is designated as Rural Residential, RR20, (1 dwelling unit per 20 acres). The northern portion of the West Kitsap conservation unit is dominated by naval submarine base Bangor.

Understanding future population growth, and its associated development, is critical to determine the potential future impacts to summer chum salmon habitat. A build-out analysis was conducted for the summer chum salmon ESU geographic area. This analysis used impervious surface area as a proxy for development. Based on existing land use designations (which are unique to each individual County), future impervious surface area was calculated and modeled. The amount of additional impervious surface area (relative to current), and where it can be expected to occur, was determined for each County. Appendix C provides details of the methods used to conduct these build-out analyses.

Build-out was also analyzed for the West Kitsap conservation unit as per the methods described in Appendix C. Figure 12.7 shows current impervious area compared with the impervious area expected after build-out.

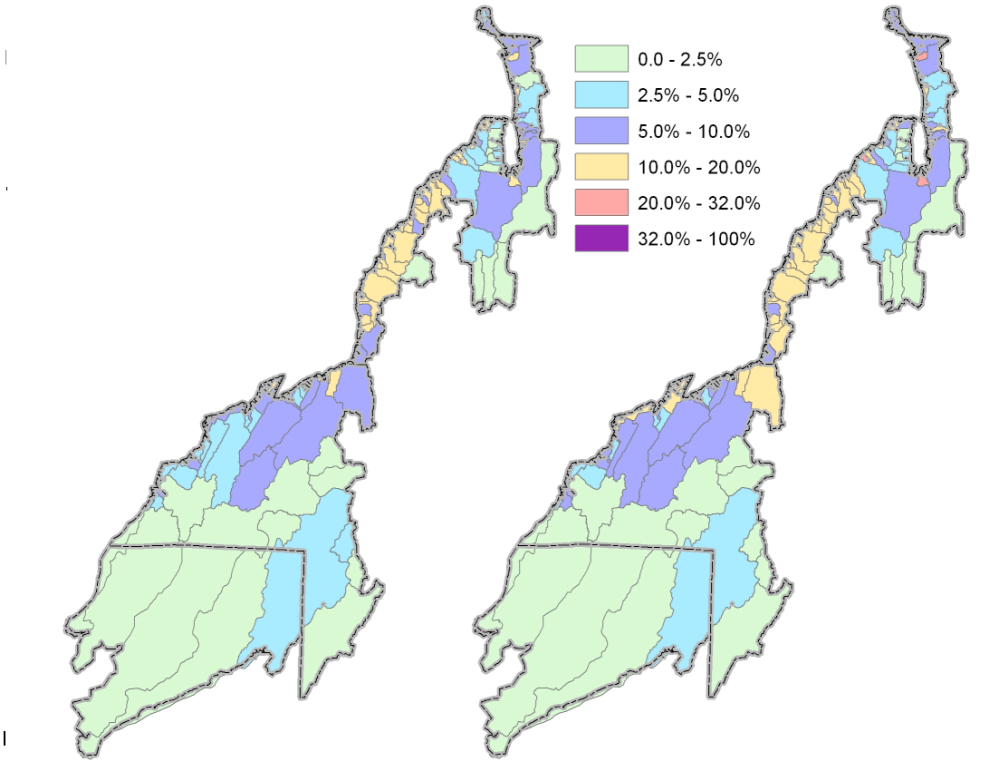

Figure 12.7. Modeled current impervious area compared with the impervious area expected after build-out (map and build-out analysis prepared by Gretchen Peterson, PetersonGIS).

Current and projected development, in the Big Beef Creek and Big Anderson Creek watersheds, was analyzed (Peterson 2005, see Appendix C). Riparian corridors were delineated from 200 feet on either side of the river from the mouth upstream to the extent of presumed summer chum salmon distribution. Impervious surface area (IP) was measured using 5-meter resolution satellite imagery. Table 12.2 summarizes the current impervious area and impervious area expected after build-out.

Table 12.2. Current impervious area (IP) and modeled build-out for the riparian corridors of the lower Big Beef Creek and Big Anderson Creek watersheds.

Riparian Corridor	Corridor area acres	Current IP acres	Build-out IP acres	Added IP acres	Current IP%	Build-out IP%
Big Beef Creek	308	19.5	23.2	3.7	6.3	7.5
Big Anderson Creek	83.1	1.6	1.8	0.2	1.9	2.2

The uplands and nearshore, within one mile of the Big Beef Creek and Big Anderson Creek subestuaries, were also analyzed for projected build-out (Peterson 2005). The results of this analysis are summarized in Table 12.3.

Table 12.3. Current impervious area (IP) and modeled build-out for the subestuaries of Big Beef and Big Anderson Creeks.

Estuary	Current IP%	Build-out IP%
Big Beef Creek	3.7	9.1
Big Anderson Creek	7.0	8.7

The largest impacts from future growth are expected to be in the lower Big Beef Creek and lower Seabeck Creek watersheds. Watershed and stream research, which typically looks at a watershed-wide perspective, generally indicates that certain zones of stream quality exist. Most notably, at about 10% impervious cover area, sensitive stream elements are lost from the system. A second threshold appears to exist at around 25 to 30% impervious area, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores).[49] More research is needed to determine if this research directly applies to the present analysis. It should be noted that similar research, however, has not been conducted for estuary and subestuary areas.

The remainder of the West Kitsap conservation unit is not expected to change significantly from current land use conditions. It is assuming the current land use

[49] See The Center for Watershed Protection's (http://www.cwp.org) Stormwater Manager Resource Center at http://www.stormwatercenter.net for more extensive references on this subject. Table 1 at http://www.stormwatercenter.net/monitoring and assessment/imp cover/impercovr model.htm reviews the key findings of recent research regarding the impacts of urbanization on aquatic systems.

regulations will remain in effect through the duration of the recovery of summer chum salmon.

12.5. Specific action recommendations

Section 12.5 presents specific recovery action recommendations for the West Kitsap conservation unit. Recommended actions are categorized as either Programmatic (section 12.5.1) or Project (section 12.5.2). Actions identified will be further delineated as actions to benefit the summer chum salmon ESU. Specific action recommendations are also summarized and analyzed in the context of overall ESU-wide recovery (see section 13). All actions (previously implemented, on-going, and proposed) will become part of the Monitoring and Adaptive Management Program for the SRP as described in section 14.

12.5.1. Programmatic recommendations

Programmatic recovery actions are those that are part of a policy, program, or process. They are generally of a regulatory or planning process nature. Programmatic actions could be part of a County's land use and regulatory program and structures or watershed planning processes. Comprehensive plans, critical areas ordinances, shoreline management master programs, and zoning could all be considered programmatic actions in this context. Programmatic actions are non-project (i.e., habitat restoration projects--LWD placement, culvert repairs, etc.) in nature. Programmatic actions, however, can include projects when such projects are descriptive of a comprehensive or encompassing process (i.e., levee removal or set back as part of an estuary restoration plan). Watershed management plans often include projects to address identified factors of decline or specific habitat conditions. For the purposes of this SRP, the management plans or planning processes will be considered programmatic actions whereas the projects identified within the management plans will be categorized as projects.

To most effectively address those factors that are likely affecting the performance of the spawning aggregations in this conservation unit, the SRP recommends the programmatic actions summarized in Table 12.4. Details of the programmatic actions approved and those being considered by the Kitsap County and Mason County Boards of County Commissioners can be found in section 13.

Table 12.4. SRP recommended programmatic actions for the West Kitsap conservation unit.

Recommended Programmatic Actions	Actions involved	Limiting factors to address
Update Kitsap County's Shoreline Master Plan in 2011 and the current update of the County's CAOs (see SRP section 13 for more details regarding Kitsap County's programmatic actions)	-An evaluation of the criteria for allowing docks and piers that considers the protection of herring habitat. -Identification of herring habitat spawning areas as habitats of local importance requiring habitat management plans. -Consideration of cumulative effects from overwater structures in updating the SMP (for example, build out scenarios with overwater structures), taking into account processes that control functions. -The gathering of information from studies that will be used to inform land use planners and managers to best manage natural resources. -Development of incentive programs to encourage community docks vs. single-family docks. Instead of the use of site-by-site overwater structure permits, use long range planning tools to address potential impacts to eelgrass areas. -Actively seek funding to support protection and restoration of existing forage fish spawning areas. -Adopt proposed revisions to the Critical Areas Ordinance, including extending buffers for shorelines designated as "Conservancy" to 50 ft. and adopting Ecology's wetland rating system and recommended flexible buffers options. -monitor long-term effectiveness of the zoning codes and enforcement	-poor riparian condition -loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) -Flow (summer low and peak flows) -Sediment aggradation, fines -Riparian degradation -Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Conduct a Nearshore Assessment (to be completed in April 2007).	- The nearshore assessment will 1) conduct a baseline characterization of the County's nearshore environment and assess its ecological health and function, 2) identify restoration and preservation opportunities and develop a strategy for ranking and prioritizing those opportunities, and 3) develop a management framework based on functions and processes of nearshore ecology. The assessment will provide a baseline from which results of nearshore protection/restoration actions may be evaluated allowing an adaptive management approach to future nearshore activities.	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Adopt the Kitsap County	- includes dual designations for some	-Estuarine habitat

Draft Shoreline Environmental Designations (subject to the required public review and adoption process)	areas that include important habitat types for forage fish spawning. Dual designations provide one designation for the above the ordinary high water (OHW) line to reflect current and surrounding land uses and a more restrictive designation for nearshore areas below the OHW line.	loss and degradation (diking, filling, log storage, road causeways)
Community Nearshore Restoration Program	-pursue application and implementation of a Community Nearshore Restoration program similar to that being conducted in south Hood Canal (see section 13)	-estuarine and nearshore habitat loss and degradation

12.5.2. Project recommendations

Project recovery actions are generally physical modifications to the landscape designed to address specific habitat situations in specific and limited geographic areas. Projects in the summer chum salmon ESU have been in process for many years by a variety of groups and entities. Section 12.5.2.1 provides an overview of existing projects relative to summer chum salmon recovery planning. Many of the project recommendations presented in this SRP are from the HCCC Lead Entity strategy (HCCC 2004). This SRP is designed to coordinate with, and build on that strategy. Projects presented are categorized according to their benefit for the waterhsed of concern. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

12.5.2.1. Existing projects

Figure 12.8 shows the existing projects for Big Beef Creek.

Figure 12.8. Existing projects located in the Lower Big Beef watershed (map produced by Gretchen Peterson-PetersonGIS with a portion of the Protected Area Data provided by CommEn Space and the HCCC LE Strategy-Richard Brocksmith).

The existing summer chum salmon recovery project for Big Beef Creek are described below (project descriptions are derived from IAC Grant Projects at http://www.iac.wa.gov/maps/default.asp and click on the Grant Project Maps link, accessed on June 14, 2005):

99-1372 UW Research Station Wetlands Restoration Project Description: A multi-disciplinary team from Point No Point Treaty Council, UW, WDFW, USFWS, NMFS, Kitsap County & the Hood Canal Salmon Enhancement Group developed the Hood Canal Summer Chum Habitat Recovery Plan to restore Big Beef Creek habitat for threatened summer chum. Phase 1 of this project re-established a spawning channel & gathered hydrology data on the lower basin, which will be used to guide future large-scale restoration efforts. Phase II will relocate a well enabling the reconnection of a 30-acre wetland with the mainstem of Big Beef Creek and line the spawning channel with boulders. This will directly address the primary limiting factor to natural production of summer chum in Big Beef: sediment aggradation/deficient channel complexity in the lower reaches. The road separating the wetland from the mainstem protects a waterline from a

high capacity well that provides water for NMFS' and UW's research projects. Rerouting the waterline is not economically or technically feasible at this time; the best alternative is well relocation closer to the main Research Station. DOE has approved the water rights transfer.

99-1672 Big Beef Creek Summer Chum Recovery Project Description:
The goal of this multi-phase project is to re-establish self-sustaining wild summer chum salmon in Big Beef Creek. The early stages of the effort will involve reintroducing the extirpated stock to the watershed in a means that produces sufficient numbers of spawners to reproduce in natural and artificial settings. Inherent in this stage will be careful monitoring of the success rates of each production type. Subsequent stages will involve restoring sufficient habitat and channel stability to support wild self-sustaining runs, restoring estuarine habitat, and preserving key elements of the watershed to maintain adequate riparian function and hydrology. In this phase of the project we will re-establish a spawning channel to create the capacity to produce summer chum using various production types. University and agency scientists will analyze success rates of each production type. We will also, to the extent funds allow, restore habitat by reconnecting a 30-acre wetland and the mainstem of Big Beef Creek. Big Beef Creek, a tributary of Hood Canal, is an extremely important salmon stream. Scientists from WDFW, NMFS, UW, USFWS, and Point No Point Treaty developed this proposal jointly. The Hood Canal Salmon Enhancement Group managed the project, with oversight provided jointly by the other cooperators.

00-1181 Big Beef Creek Preservation Project Description:
The University of Washington Fisheries Research Station at Big Beef Creek, on Hood Canal's east side, has been the site of a three-phase effort to improve fish habitat. Funding will help to preserve the 30-acre wetland on the west side of Big Beef Creek just upstream of the research facility by removing an existing water utility road access. The road has altered the natural functions of the wetland, and with minor adjustments to the utility lines the wetland will be reconnected to the creek and restored it to its natural state. The project will also line 200 feet of the spawning channel with large cobble to prevent erosion.

To most effectively address those factors that are likely affecting the performance of the summer chum salmon in the West Kitsap conservation unit, the SRP recommends the following projects. All projects that are proposed or recommended in this SRP are strictly voluntary in nature. Those projects that would either take place on, or impact, private property will require the full cooperation and permission from the affected landowners before proceeding. If that landowner permission cannot be obtained, those projects will not proceed.

Table 12.5. SRP recommended projects for the West Kitsap conservation unit.

Big Beef Creek-

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore natural tidal influence and sediment transport in the Big Beef Creek subestuary by addressing causeway and hatchery weir.	-County Road (300 meter raised causeway if removing 4 to 5 residences, or 250 meter with houses remaining) and UW weir	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore tidal processes and lost salt marsh habitat at the mouth of Johnson Creek	-need to work with landowners to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Address causeway impacts to restore estuary and floodplain	-need to work with Kitsap County and landowners to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove UW service road and associated fill	-Work with UW to implement	
Restore natural tidal influence and sediment transport in the Big Beef Creek subestuary by addressing causeway and hatchery weir.	-County Road (300 meter raised causeway if removing 4 to 5 residences, or 250 meter with houses remaining) and UW weir -will need to work with County, UW, and private landowner/residents to determine design and feasibility	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Big Anderson Creek

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Restore historic salt marsh and lagoon habitats at the community of Holly.	-working with private landowners is critical	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove the county road along the north shore of Anderson Cove (traffic could be rerouted to the road immediately to the north) and revegetate the riparian zone with native plants.	-work with Kitsap County to develop feasibility, design and costs	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove old railroad grade and pilings from the head of Anderson Cove.	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Dewatto River

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove abandoned dikes on the salt marsh at the head of Dewatto Bay	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Remove fill and restore lost mudflat habitat at the Oyster House and artificial boat basin on the south shore of Dewatto Bay.	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)
Restore tidal processes and salt marsh habitat at the unnamed stream about one mile north of the mouth of Dewatto Bay.	-working with private landowners is critical to removing landfill	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)

Seabeck Creek

Project/Action	Tasks involved, sub-actions, barriers to implementation	Limiting factors to address
Remove railroad fill to restore estuary and nearshore	-will need to work with landowner to determine feasibility and design	-Estuarine habitat loss and degradation (diking, filling, log storage, road causeways)